KOKAI PATENT APPLICATION NO. SHO 58-218753

Battery

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Battery

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Specification

Title of the invention

Battery

Claim of the invention

A battery comprising a positive electrode component, a separator, and a negative electrode is stored in a sealed case, which battery is characterized by the fact that the side area of the separator of the above-mentioned negative electrode are reduced compared to the size of the area opposite said area.

Detailed description of the invention

The present invention pertains to a battery with improved flatness of the discharge voltage characteristic.

In recent years, as a battery used for small electrical and electronic equipment such as calculators and electronic watches, flat batteries referred to as button or coin batteries are used. Alkaline batteries that utilize silver oxide are used for the above-mentioned flat batteries, but because of the high discharge capacity, lithium batteries where lithium is used for the negative electrode are gaining attention. For the above-mentioned lithium batteries, many different types

of batteries exist depending on the application and seal structure. Fig. 1 is a cross-section of a flat lithium battery having a widely-used gasket seal structure. In Fig. 1, 1 is the sealed case, and battery structural component 2 is contained inside said case. The aforementioned sealed case 1 has a structure consisting of negative electrode can 3 and positive electrode can 4 and gasket 5 made of a material such as polypropylene. The aforementioned sealed case is a structure consisting of a laminate of positive electrode component 6 produced by kneading manganese dioxide powder, fluorographite, or a mixture of the two with a conductive coagent and binder, molding, and baking the mixture, a separator 7 impregnated with a non-aqueous electrolyte prepared by dissolving a solute such as lithium perchlorate or lithium borofluoride in a solvent such as propylene carbonate, 1,2-dimethoxy ethane, tetrahydrofuran, γ-butylolactone and mixtures thereof, and negative electrode 8 made of lithium, and positive electrode collector 9 made of stainless steel, etc. can be inserted between the aforementioned positive electrode can 3 and negative electrode component 6, or negative electrode collector 10 made of a mesh or expanded metal such as stainless steel or nickel can be included in the aforementioned negative electrode can 3, as needed. In general, the above-mentioned positive electrode collector 9 and negative electrode collector 10 are formed integrally with the positive electrode component 6 and negative electrode 8.

In the battery having the above-mentioned structure, charge voltage is reduced as discharge occurs. The reason is that the internal resistance of battery structure 2 itself and that at and between the battery structure and sealed case 1 increases with discharge. The above-mentioned reduction in discharge voltage with discharge is not desirable for electrical and electronic equipment, and in some cases, a constant-voltage circuit is required.

Based on the above-mentioned background, the main purpose of the present invention is to produce a battery with a reduced discharge voltage drop accompanying discharge.

In summary, the area on the separator side of the negative electrode is reduced compared to the area of the opposite side in the present invention.

In the following, the present invention is explained in further detail with reference to the drawings.

Fig. 2 is a cross-section that shows a flat lithium battery having the gasket structure of the present invention. In the figure, the parts are shown with the same codes as in Fig. 1. In this case, the shape of negative electrode 11 is different from the one shown in Fig. 1. In other words, in negative electrode 8 shown in Fig. 1, the area of the negative electrode on the side of separator 7 and the area on the opposite side have the same wedge-shaped cross-section; on the other hand, the area of the negative electrode 11 shown in Fig. 2 on the separator side is smaller than the area on the opposite side, and in the example shown in the figure, a tapered surface 11a is formed at the edges so that the cross-section increases from the separator toward the negative electrode collector 10.

According to the above-mentioned structure, the contact area of negative electrode 11 with separator 7 is reduced compared to that of the conventional type; thus, the initial discharge resistance is relatively high as a result of the reduction in discharge area, and the discharge voltage is slightly lower than the conventional type. However, the consumption of negative electrode 11 begins at the area in contact with separator 7 as discharge occurs as a result of the discharge reaction, and the contact area between the negative electrode and the separator is gradually increased, and the increase in internal resistance that accompanies the reduction in

thickness of the negative electrode as a result of the discharge reaction is compensated for by the increase in discharge area of the negative electrode; thus, the drop in discharge voltage is less as shown by the solid line of curve A in Fig. 3. On the other hand, in the conventional battery shown in Fig. 1, the area of negative electrode 8 on the side of separator 7 is large to begin with; thus, the internal resistance at the time of initial discharge is low, and the initial discharge voltage is higher than that of the battery of the present invention, but the discharge voltage undergoes a sharp reduction due to the reduced thickness of negative electrode 8 based on discharge; thus, the dotted line of curve B in Fig. 3 is obtained. As shown in the figure, it is obvious that discharge characteristics of the battery of the present invention are superior to the conventional type.

Furthermore, in the above-mentioned application example, the case is shown where tapered surface 11a is formed at the edges of the negative electrode on the side of separator 7 so that the area of the negative electrode on the separator side is smaller than the area on the opposite side, but the same good effect can be achieved when one or more steps 12a are formed at the edge of negative electrode 12 on the separator 7 side as shown in Fig. 4. Furthermore, the same good effect can be achieved when the same size is used for the external dimensions of negative electrode 13 at the separator side and the opposite side and a recessed region 13a having a wedge-shaped cross-section or recessed portion 13b having a triangular cross section are formed as shown in Fig. 5.

As explained above, the area of the negative electrode on the separator side is formed to be smaller than the opposite side; thus, the increase in internal resistance due to the reduction in thickness of the negative electrode that accompanies discharge can be compensated for by the reduction in internal resistance based on a continuous or step-wise increase in discharge area of

the negative electrode; thus, the flatness of the discharge characteristic can be improved significantly.

Brief description of the figures

Fig. 1 is a cross-section of a conventional flat lithium battery, Fig. 2 is a cross-section of a flat lithium battery that serves as an application example of the present invention, Fig. 3 shows the discharge voltage characteristics of the battery of the present invention and a conventional battery, and Fig. 4 and Fig. 5 are cross-sections of flat lithium batteries showing different examples of the present invention.

1 ... Sealed case, 2 ... Battery structure, 6 ... Positive electrode component, 7 ... Separator; 11, 12, 13 ... negative electrode, 11a ... Tapered surface, 12a ... Step, 13a, 13b ... Recessed areas.

Applicant: Shin-Nippondenki Co., Ltd.

Fig. 1

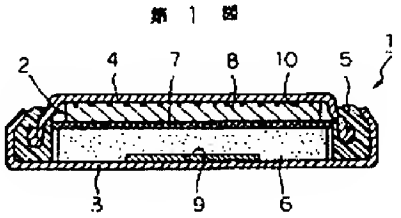


Fig. 2

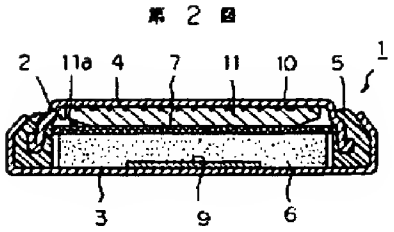
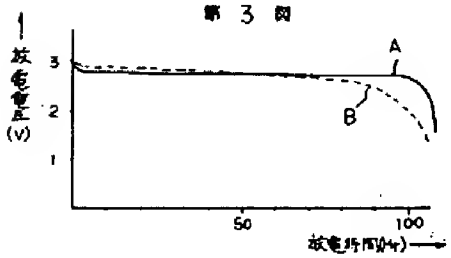


Fig. 3



Vertical axis: Discharge voltage (V)

Horizontal axis: Discharge time (Hr)

Fig. 4

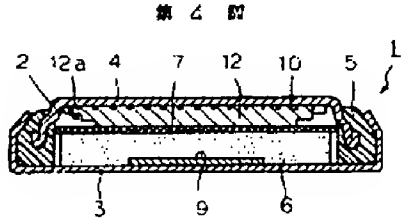


Fig. 5

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